

## Curriculum of 1<sup>st</sup> year BTech (common to all the disciplines)

### Semester I

Curriculum of 1 <sup>st</sup> Year B. Tech. Program (From AY 2010-11 to AY 2013-14)				Curriculum of 1 <sup>st</sup> Year B. Tech. Program (From AY 2014-15 onwards)			
Course Code	Course Title	Weekly Contact Hours (L-T-P)	Credits	Course Code	Course Title	Weekly Contact Hours (L-T-P)	Credits
CH 103	Chemistry	3-1-0	4	CH 103	Chemistry	3-1-0	4
MA 103	Mathematics-I (Calculus)	3-1-0	4	MA 105	Calculus	3-1-0	4
PH 103	Physics-I (Modern Physics)	2-1-0	3	PH 105	Physics-I	2-1-0	3
HS 107	English Language and Literature	2-0-0	2	HS 159	English Language and Communication	0-3-0	3
CS 103	Computer Programming	2-0-0	2	CS 103	Computer Programming	2-0-0	2
CH 153	Chemistry Lab	0-0-3	1.5	CH 153	Chemistry Lab	0-0-3	1.5
HS 157	English Language Lab	0-0-2	1				
CS 153	Computer Programming Lab	0-0-3	1.5	CS 153	Computer Programming Lab	0-0-3	1.5
ME 153	Engineering Graphics	1-0-3	2.5	IC 153	Engineering Graphics	1-0-3	2.5
NC 101/ NO 101/ NS 101	National Cadet Corps (NCC) National Sports Organization (NSO) National Service Scheme (NSS)	0-0-0 0-0-0 0-0-0	P/NP P/NP P/NP	NC 101/ NO 101/ NS 101	National Cadet Corps (NCC) National Sports Organization (NSO) National Service Scheme (NSS)	0-0-0 0-0-0 0-0-0	P/NP P/NP P/NP
<b>Total</b>		<b>13-3-11</b>	<b>21.5</b>	<b>Total</b>		<b>11-6-9</b>	<b>21.5</b>

### Semester II

Curriculum of 1 <sup>st</sup> Year B. Tech. Program (From AY 2010-11 to AY 2013-14)				Curriculum of 1 <sup>st</sup> Year B. Tech. Program (From AY 2014-15 onwards)			
Course Code	Course Title	Weekly Contact Hours (L-T-P)	Credits	Course Code	Course Title	Weekly Contact Hours (L-T-P)	Credits
MA 104	Mathematics-II (Linear Algebra and Ordinary Differential Equations-I)	3-1-0	4	MA 106	Linear Algebra and Ordinary Differential Equations-I	3-1-0	4
PH 104	Physics-II (Electricity and Magnetism)	2-1-0	3	PH 106	Physics-II	2-1-0	3
				BSE 102	Bio-Sciences	2-1-0	3
HS 108	Fundamentals of Economics	3-0-0	3	HS 108	Fundamentals of Economics	3-0-0	3
EE 104	Basic Electrical and Electronics Engineering	2-1-0	3	EE 104	Basic Electrical and Electronics Engineering	2-1-0	3
ME 104	Basic Mechanical Engineering	3-0-0	3	ME 106	Basic Mechanical Engineering	2-1-0	3
PH 154	Physics Lab	0-0-3	1.5	PH 156	Physics Lab	0-0-3	1.5
EE 154	Basic Electrical and Electronics Engineering Lab	0-0-2	1	EE 154	Basic Electrical and Electronics Engineering Lab	0-0-2	1
ME 154	Basic Manufacturing Techniques	2-0-2	3	IC 156	Basic Manufacturing Techniques	0-0-3	1.5
NC 102/ NO 102/ NS 102	National Cadet Corps (NCC) National Sports Organization (NSO) National Service Scheme (NSS)	0-0-0 0-0-0 0-0-0	P/NP P/NP P/NP	NC 102 / NO 102 / NS 102	National Cadet Corps (NCC) National Sports Organization (NSO) National Service Scheme (NSS)	0-0-0 0-0-0 0-0-0	P/NP P/NP P/NP
<b>Total</b>		<b>15-3-7</b>	<b>21.5</b>	<b>Total</b>		<b>15-4-8</b>	<b>23</b>

## Structure of the Minor programs [from AY 2014-15 onwards]

A student has to register and pass at least FIVE courses (three core courses and two elective courses) as prescribed for a minor program in order to get a minor degree in that specialization along with the regular BTech degree in his/her engineering discipline. A minor program will run only when at least TEN students register for it. Following minor programs are available from AY 2014-15 onwards.

**1. Minor program in Biosciences and Biomedical Engineering (BSBE):** To get a minor degree in BSBE, a student needs to register and pass **at least FIVE prescribed courses excluding the core course** BSE 101 Bio-Sciences for successful minor degree in BSBE.

**2. MINOR PROGRAM IN CHEMISTRY:** To get a minor degree in Chemistry, a student needs to register and pass **at least FIVE prescribed courses excluding the core course CH 103**. Following are courses for successful minor degree in Chemistry.

**3. Minor Program in HSS:** The School of Humanities and Social Sciences offer **2 Minor Programs:** one in "**Humanities**" and another in "**Social Sciences**". A student needs to register and pass **at least FIVE prescribed Humanities or Social Sciences courses excluding the core courses** HS 159 and HS 108 for successful minor degree in Humanities or Social Sciences. A student who does 4 courses from Humanities and 1 course from Social Sciences and *vice versa* will be eligible for Minor Degree in HSS.

**4. Minor Program in Astronomy (from AY 2016-17):** To get a minor degree in Astronomy, a student needs to register and pass **at least FIVE prescribed courses**. Following are courses for successful minor degree in Astronomy.

Following are the course structures of these minor programs

Semester: Minor course number	Minor Program in BSBE	Minor Program in Chemistry	Minor Program in Humanities	Minor Program in Social Sciences	Minor Program in Astronomy (from AY 2016-17 onwards)
3 <sup>rd</sup> : Minor1	BSE 201: Biophysics	CH 201: Molecules that Change the World	HS 201: Understanding Philosophy HS 207: French Language-I	HS 203: Psychology HS 205: Sociology	AA 201: Introduction to Astronomy
4 <sup>th</sup> : Minor 2	BSE 202: Biomedical Technologies	CH 202: Chemistry of Transition Metals and Lanthanides <sup>&amp;</sup>	HS 206: Paradigms and Turning Points HS 208: French Language-II	HS 210: Indian Economy	AA 202: Engineering for Astronomy
5 <sup>th</sup> : Minor 3	BSE 301: Introduction to Molecular Biology	CH 301: Functional Materials	HS 311: Life and Thought of Gandhi HS 313: History of Early Cinema HS 341: Appreciating Indian English Literature	HS 323: International Economics	AA 301: High Energy Astronomy
8 <sup>th</sup> : Two elective courses as Minor 4 & Minor 5	BSE 402: Cancer Diagnosis and Therapy BSE 404/ BSE 604: Biomedical Imaging BSE 405/ BSE 605: Molecular Biophysics EE 419/ EE 619: Biomedical Optics ME 407/ME 607: Bio-fluid Mechanics	CH 402: Chemistry in Industry  CH 404: Chemical Physics  CH 406: Nuclear Science	IHS 402: Twentieth Century World History: Critical Perspectives  IHS 443/ HS 643: Contemporary Short Fiction  IHS 444: Literature of the Twentieth Century	IHS 422 / HS 622: Development Economics IHS 425: Money and Banking HS 426: Economics of Innovation IHS 482: Introduction to International Development and Area Studies	AA 471 / AA 671: Relativity, Cosmology and the Early Universe  AA 472 / AA 672: Extragalactic Astronomy  AA 474 / AA 674: Basics of Radio Astronomy

<sup>&</sup> A student who takes CH 202 will not be allowed to take ME 416/616 in his/her 8<sup>th</sup> Semester

**Syllabi  
of  
Compulsory Basic Science Courses  
(CBSC)**

1.	Course Code	<b>BSE 102</b> [from AY 2014-15 onwards]
2.	Title of the Course	<b>Biosciences</b>
3.	Credit Structure	L-T-P-Credits 2-1-0-3
4.	Name of the Concerned Discipline	Biosciences and Biomedical Engineering
5.	Pre-requisite, if any	Nil
6.	Scope of the course	This course intends to give knowledge about the basics of biology to engineering students who might not be in touch with this subject after their matriculation.
7.	Course Syllabus	<p><b>Life and its origin:</b> Requirements for Life, Chemistry of life, Chemistry of water, Origin of life.</p> <p><b>Evolutionary History of Biological Diversity:</b> Phylogeny and the Tree of Life, Bacteria and Archaea, Protists. Plant Diversity I: How Plants Colonized Land, Plant Diversity II: The Evolution of Seed Plants, Fungi, An Overview of Animal Diversity, An Introduction to Invertebrates, The Origin and Evolution of Vertebrates</p> <p><b>Cell:</b> Prokaryotic and Eukaryotic cell, Animal cell and Plant cell, Structure and function of sub cellular organization, membrane and cell physiology, Chromosome and Gene, Genetics</p> <p><b>Cell Division:</b> Mitosis, Meiosis other types of cell divisions, Cancer</p> <p><b>Organization of Human body:</b> Tissues, Organ and Organ System;</p> <p><b>Micro- and Macromolecules in living system:</b> Amino Acid, Proteins, Types of sugar, Carbohydrates, Saturated and unsaturated fatty acid, lipid, Fat, Nucleotides and Nucleic Acid.</p> <p><b>Enzymes:</b> Basic concept, Classification and Function, Role of Enzymes in life.</p> <p><b>Ecology and Environment</b></p> <p><b>Perspective of Biology</b></p>
8.	Suggested Books	<ol style="list-style-type: none"> <li>1. Campbell; <b>Biology</b>, 9<sup>th</sup> edition. Pearson Higher Education 2011</li> <li>2. Colleen Belk, Virginia Borden Maier; <b>Biology: Science for Life with Physiology</b>, Pearson New International Edition, 2013</li> <li>3. Lehninger &amp; Cox. <b>Principles of Biochemistry</b> (5th edition), W.H. Freeman &amp; Company, USA</li> </ol>

**Minor Program**  
**in**  
**Biosciences and Biomedical Engineering (BSBE)**  
**(from AY 2014-15 onwards)**

1.	Course Code	<b>BSE 201</b>
2.	Title of the Course	<b>Biophysics</b>
3.	Credit Structure	L-T-P-Credits 2-1-0-3
4.	Name of the Discipline	Biosciences and Biomedical Engineering
5.	Pre-requisite, if any	None
6.	Scope of the Course	This course will introduce students with the physical laws that govern biology. It will also focus on various physical techniques used in biology and medicine for characterization and diagnosis.
7.	Course Syllabus	<p>Introduction to macroscopic and microscopic aspect of matter.</p> <p>Schrödinger equation, H-atom, chemical bonds.</p> <p>Quantitative discussion of Entropy, free energy, partition function, diffusion and rate equations.</p> <p>Basic principles of spectroscopy, particularly electronic, vibrational, rotational and magnetic resonance.</p> <p>Applications of spectroscopy techniques to understand biological, and medical systems.</p> <p>The physical basis of diffusive processes in biology and biochemistry.</p> <p>Optical microscopy fundamentals, visible and UV light absorption, fluorescence and phosphorescence, quasielastic light scattering.</p> <p>Biological networks, and chaos in biological systems.</p>
8.	Suggested Books	<p><b>Text / Reference Books</b></p> <ol style="list-style-type: none"> <li>1. Philip Nelson, Biological Physics, 2007, First edition. [ISBN-10: 0716798972   ISBN-13: 978-0716798972]</li> <li>2. William Bialik, Biophysics: Searching for Principles, 2012. [ISBN-10: 0691138915   ISBN-13: 978-0691138916]</li> <li>3. Jack Tuszynski, Michal Kurzynski, Introduction to Molecular Biophysics. [ISBN-10: 0849300398   ISBN-13: 978-0849300394] CRC Series in Pure and Applied Physics</li> <li>4. James G. Fujimoto and Daniel Farkas, Biomedical optical imaging, 1st edition. [ISBN-10: 0195150449]</li> </ol>

1.	Course Code	<b>BSE 202</b>
2.	Title of the Course	<b>Biomedical Technologies</b>
3.	Credit Structure	L-T-P-Credits 2-1-0-3
4.	Name of the Concerned Discipline	Biosciences and Biomedical Engineering
5.	Pre-requisite, if any	None
6.	Scope of the Course	This course will focus on the basic working principles of common medical instruments that are routinely used in clinics. It will also discuss basic design considerations of biomedical instrumentation.
7.	Course Syllabus	<p>Electrocardiography system: Electrocardiograph, ECG machines, instrumentation amplifier, ECG traces, faults and maintenance.</p> <p>Electroencephalography system: Overview, EEG electrodes, introduction to filters, EMG and related studies.</p> <p>Blood pressure measurement: Heart mechanics and blood pressure basics, non-invasive and invasive methods,</p> <p>Pacemakers: Pacing basics, external and internal pacemakers, defibrillators.</p> <p>Ventilators and respirators.</p> <p>Lasers and their applications in medicine and biology.</p> <p>Medical Imaging: X-rays, MRI, PET, mammography, ultrasound and other developing technologies.</p>
8.	Suggested Books	<p><b>Text / Reference Books</b></p> <ol style="list-style-type: none"> <li>1. J. Carr and J. Brown, Introduction to Biomedical Equipment and Technology, 4<sup>th</sup> edition. [ISBN-10: 0130104922   ISBN-13: 978-0130104922]</li> <li>2. R. Aston, Principles of Biomedical Instrumentation and Measurement, 1<sup>st</sup> edition. [ISBN-10: 0675209439   ISBN-13: 978-0675209434]</li> <li>3. Leslie Cromwell, Fred J. Weibell, Erich A. Pfeiffer, Bio-Medical Instrumentation and Measurements, 2<sup>nd</sup> edition, Pearson Education. [ISBN-10: 0130764485   ISBN-13: 978-0130764485]</li> <li>4. John G. Webster, Medical Instrumentation: Application and Design, 4th edition, Wiley, New York. [ISBN-10: 0471676004   ISBN-13: 978-0471676003]</li> </ol>

1.	Course Code	<b>BSE 301</b>
2.	Title of the Course	<b>Introduction to Molecular Biology</b>
3.	Credit Structure	L-T-P-Credits 2-1-0-3
4.	Name of the Discipline	Biosciences and Biomedical Engineering
5.	Pre-requisite, if any	None
6.	Scope of the Course	This course will give an overview of modern biology, in addition to fundamentals in the area of Molecular Biology.
7.	Course Syllabus	<p>Macromolecules and Cells, Nucleus, Cell Cycle.</p> <p><b>DNA the unit of life:</b> Structure, Properties, Mutations, Repair and Diseases.</p> <p>Flow of genetic information: Replication of DNA and its repair,</p> <p><b>RNA:</b> the ribonucleic acid, Structure, Properties, Transcription of RNA and its modification, Gene expression, Introns-exons.</p> <p>Exploring genes and genomes.</p> <p><b>Translation:</b> Genetic Code, Protein synthesis, Function and structure of Proteins.</p> <p>Recombinant DNA technology, sequences of genomes, manipulation of eukaryotic genes.</p> <p><b>Omics:</b> Genomics, transcriptomics and proteomics.</p>
8.	Suggested Books	<p><b>Text / Reference Books</b></p> <ol style="list-style-type: none"> <li>1. Robert F., Weaver, Molecular Biology, 4th ed., McGraw-Hill, 2003. [ISBN-10: 0071275487   ISBN-13: 978-0071275484]</li> <li>2. Lodish H., et al., Molecular Cell Biology. 6th ed., Freeman, W.H., 2007. [ISBN-10: 0716776014   ISBN-13: 978-0716776017]</li> <li>3. Alberts et al., Molecular Biology of the Cell, 4th ed., Garland Publishing, Inc., 2002.</li> <li>4. Tropp B.E., Molecular Biology: Genes to Proteins, 3rd ed., Jones &amp; Bartlett Publishers, 2007 [ ISBN-10: 0763709166 ISBN-13: 978-0763709167]</li> </ol>



1.	Course Code	<b>BSE 402</b>
2.	Title of the Course	<b>Cancer Diagnosis and Therapy</b>
3.	Credit Structure	L-T-P-Credits 2-1-0-3
4.	Name of the Discipline	Bioscience and Biomedical Engineering
5.	Pre-requisite, if any	None
6.	Scope of the Course	The purpose of this course is to provide an introduction to cancer and modern diagnostic methods available to detect cancer at an earlier stage. The diagnostic methods will include invasive and non-invasive methods.
7.	Course Syllabus	<p><b>Introduction</b> Definition, Benign Tumors Vs. Malignant Tumors, Types of Cancer, Common Symptoms, Molecular Hallmarks of Cancer – Growth Signal Autonomy, Evasion of Growth Inhibitory Signals, Evasion of Apoptosis (Programmed Cell Death), Unlimited Replicative Potential, Angiogenesis (Formation of New Blood Vessels), Invasion and Metastasis, Molecular Basis of Cancer - Cancer Genes (Oncogenes and Tumor Suppressor Genes), Carcinogenesis – A Multistep Process, Evidences for Multistage Models of Carcinogenesis</p> <p><b>Diagnostic Methods and Therapy</b> <b>Cancer Screening and Treatment Modalities:</b> Screening - Definition, Principles, Evaluating Screening Tests, Developing and evaluating a Cancer Screening Programme, Different Kind of Screening Tests, Screening for Specific Types of Cancer, Genetic Counselling; Treatment – Essential Terms, Surgery, Radiation, Chemotherapy, Biological Therapy, Hormone Therapy, Transplantation, Targeted Therapies, Gene Therapy, Other Treatment Methods (Cryosurgery, Laser Therapy, Photodynamic Therapy, Hyperthermia), Cancer Clinical Trials</p>
8.	Suggested Books	<p><b>Text Books</b> 1. R. A. Weinberg, <b>The Biology of Cancer</b>, Garland Science, <b>2012</b>, ISBN-10: 0815340761 2. R. Hesketh, <b>Introduction to Cancer Biology</b>, Cambridge University Press, <b>2013</b>, ISBN-10: 1107601487 3. V. T. DeVita, T. S. Lawrence, S. A. Rosenberg, <b>Cancer: Principles and Practice of Oncology, 9<sup>th</sup> Edition</b>, Lippincott Williams and Wilkins, <b>2011</b>, ISBN-10: 1451105452</p> <p><b>Reference Books</b> 1. S. Heim, F. Mitelman, <b>Cancer Cytogenetics</b>, 3<sup>rd</sup> Edition, Willy-Blackwell, <b>2011</b>, ISBN-10: 0470181796 2. L. Pecorino, <b>Molecular Biology of Cancer: Mechanisms, Targets and Therapeutics</b>, Oxford University Press, <b>2008</b>, ISBN-10: 0199211485 3. <b>American Cancer Society</b>, <a href="http://www.cancer.org">http://www.cancer.org</a>. 4. <b>National Cancer Institute</b>, <a href="http://www.cancer.gov">http://www.cancer.gov</a>.</p>

1.	Course Code	<b>BSE 404 / BSE 604</b>
2.	Title of the Course	<b>Biomedical Imaging</b>
3.	Credit Structure	L-T-P-Credits 2-1-0-3
4.	Name of the Concerned Discipline	Biosciences and Biomedical Engineering
5.	Pre-requisite, if any	None
6.	Scope of the Course	This course will give a comprehensive introduction to the fundamental and major aspects of biomedical imaging systems used currently. The fundamental physics and engineering of each imaging modality will be discussed.
7.	Course Syllabus	<p>Radiation and interaction with matter, principle of diagnostic biomedical optical imaging.</p> <p>Radiation dosimetry, risk and protection.</p> <p>Radiography, mammography and fluoroscopy.</p> <p>Principle of ultrasound imaging and current status.</p> <p>Image analysis, image processing, image reconstruction theory, computed tomography system.</p> <p>Magnetic Resonance Imaging (MRI): principle of nuclear magnetic resonance, MR imaging, functional MR imaging, application of MR imaging.</p> <p>Single Photon Emission Computed Tomography (SPECT) principle, Positron Emission Tomography (PET).</p>
8.	Suggested Books	<p><b>Text / Reference Books</b></p> <ol style="list-style-type: none"> <li>1. J. T. Bushberg et al, The essential physics of medical imaging, 2<sup>nd</sup> edition. [ISBN-10: 0683301187   ISBN-13: 978-0683301182]</li> <li>2. Richard R. Carlton, Principle of radiographic imaging: An art and a science. [ISBN-10: 1439058725   ISBN-13: 978-1439058725]</li> <li>3. James G. Fujimoto and Daniel Farkas, Biomedical optical imaging, 1<sup>st</sup> edition. [ISBN-10: 0195150449]</li> <li>4. Andrew G. Webb, Introduction to biomedical imaging, 1<sup>st</sup> edition. [ISBN-10: 0471237663   ISBN-13: 978-0471237662]</li> </ol>

1.	Course Code	<b>BSE 405 / BSE 605</b>
2.	Title of the Course	<b>Molecular Biophysics</b>
3.	Credit Structure	L-T-P-Credits 2-1-0-3
4.	Name of the Concerned Discipline	Biosciences and Biomedical Engineering
5.	Pre-requisite, if any	None
6.	Scope of the Course	This course is designed to teach the basics of Physics, sufficient for BSBE graduate students. The fundamental physics of Biological phenomena will be discussed. It will also prepare students to learn and apply biophysical approaches to understand biochemical, biotechnological and medical problems.
7.	Course Syllabus	<p>Origin and evaluation of life. Discussion about various stages of evolution. Single cell machinery to multi-cellular organs.</p> <p>Structure of biomolecules. Elements of building blocks for macromolecules. Weaker interatomic interactions. Hydrogen bond and hydrophobic interactions. Amphiphilic molecular behavior in aqueous environments.</p> <p>Structures and physics of amino acids and proteins. Conformational transitions of proteins (folding and unfolding of proteins), Ramachandran plot. Physics of nucleic acid, membranes and membrane physics.</p> <p>Dynamics of biomolecules: diffusion, vibrations versus conformational transitions. Interaction of biomolecules with electromagnetic radiation.</p> <p>General characteristic of a cell. Cytoskeletal organizations and constituents molecules and their mechanism. Ion channels and ion pumps, osmotic pressure of cells.</p> <p>Cellular energetics: chloroplast and mitochondria. Cells as thermodynamic machines. Active transport.</p> <p>Bioelectricity, heart dynamics, anatomy of nerve cells, conducting properties of neurons. Structure and function of synapse.</p>
8.	Suggested Books	<p><b>Text / Reference Books</b></p> <ol style="list-style-type: none"> <li>1. Philip Nelson, Biological Physics, 1<sup>st</sup> edition. [ISBN-10: 0716798972   ISBN-13: 978-0716798972]</li> <li>2. William Bialik, Biophysics: Searching for Principles. [ISBN-10: 0691138915   ISBN-13: 978-0691138916]</li> <li>3. Jack Tuszynski, Michal Kurzynski, Introduction to Molecular Biophysics. [ISBN-10: 0849300398   ISBN-13: 978-0849300394] CRC Series in Pure and Applied Physics.</li> <li>4. Charles R. Cantor and Paul R. Schimmel, Biophysical Chemistry, Part I: The conformation of biological macromolecules (Their Biophysical Chemistry), 1<sup>st</sup> edition. [ISBN-10: 0716711885   ISBN-13: 978-0716711889]</li> <li>5. Charles R. Cantor and Paul R. Schimmel, Biophysical Chemistry, Part 2: Techniques for the study of biological structure and function, 1<sup>st</sup> edition. [ISBN-10: 0716711907   ISBN-13: 978-0716711902]</li> <li>6. Charles R. Cantor and Paul R. Schimmel, Biophysical Chemistry, Part 3: The behavior of biological macromolecules, 1<sup>st</sup> edition. [ISBN-10: 0716711923   ISBN-13: 978-0716711926]</li> </ol>